

# REPORT DOCUMENTATION PAGE

AFRL-SR-AR-TR-05-

Public reporting burden for this collection of information is estimated to average 1 hour per response, including gathering and maintaining the data needed, and completing and reviewing the collection of information. Send collection of information, including suggestions for reducing this burden, to Washington Headquarters Service, Paperwork Project, Room 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Project, Room 1204, Arlington, VA 22202-4302.

ircs,  
f this  
erson

0413

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE		3. REPC	
				15 Sep 1995 - 31 May 2003 FINAL	
4. TITLE AND SUBTITLE FUTURE AEROSPACE SCIENCE AND TECHNOLOGY CENTER FOR SPACE CRYOELECTRONICS AT FLORIDA INTERNATIONAL UNIVERSITY				5. FUNDING NUMBERS 62228D 4276/AS	
6. AUTHOR(S) DR LARKINS JR					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) FLORIDA INTERNATIONAL UNIVERSITY 11200 SW 8TH STREET UNIVERSITY PARK, CONTROLLERS OFFICER MIAMI FL 33199				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 4015 WILSON BLVD SUITE 713 ARLINGTON VA 22203				10. SPONSORING/MONITORING AGENCY REPORT NUMBER  F49620-95-1-0519	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION AVAILABILITY STATEMENT DISTRIBUTION STATEMENT A: Unlimited  <b>DISTRIBUTION STATEMENT A</b> Approved for Public Release Distribution Unlimited				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) 1. Deposition of good quality 123 and BTO films on LaA1O3 by laser ablation. 2. Surface roughness caused stiction issues have moved us to sputtered films at FIU - successful. 3. Good release and patterning using sputtered SiN and Si films for MEMs fabrication at Hanscom AFB have been demonstrated with adequate yields. Poor climate (humidity in the clean roOm) has destroyed the superconductivity of the samples making more runs necessary. Switches however DO function - problem is with the superconductor film. - Release problems have come back to haunt this effort.... 4. We demonstrated with the use of resonators incorporating switches that the insertion loss of such a switch can be less than 0.007 dB. 5. Several frequency agile resonators using switches were demonstrated along with down - state tuning of a switch.					
14. SUBJECT TERMS				15. NUMBER OF PAGES	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified		18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified		19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	
				20. LIMITATION OF ABSTRACT UL	

***Future Aerospace Science and Technology Center  
for Space Cryoelectronics  
at Florida International University  
(now strictly the MEM frequency agile work)***

**DISTRIBUTION STATEMENT A**  
Approved for Public Release  
Distribution Unlimited

*Final*  
~~Interim~~ Report  
August 2005

20051005 124

***Summary of Personnel  
Faculty (2):***

*Dr Grover Larkins*

*Dr. Yuri Vlasov*

***Engineers/Post Docs:***

*Dr. M Brezniskaya*

*Jane Wang*

***Graduate Students (7):***

*Albert Bogoz*

*Jose Martinez*

*Yazan Hijazi*

*Dane Fairweather*

*Drayton Hanna*

*Jorge Vargas*

*Leon Lawrence*

***Undergraduate Students (1):***

*James Burke*

***Color key for personnel:***

*Black -- Still in the program*

*Blue -- Graduated and left the program*

*Green -- Moved up to the next level (MS to PhD Program etc.)*

***Demographics of the FAST Center  
for Space Cryoelectronics  
at Florida International University  
2002-03***

	<i>African American</i>	<i>Hispanic</i>	<i>Women</i>	<i>Asian</i>	<i>Other</i>	<i>Total*</i>
<i>Faculty/Staff</i>	0	0	2	1	2	5
<i>Graduate Students</i>	3	2	0	0	2	7
<i>Undergraduates</i>	1	0	0	0	0	1
<i>High School</i>	0	0	0	0	0	0
<i>Total</i>	4	2	2	1	4	10

*\*Some individuals are counted more than once, for example an African-American Woman is counted as a woman and as an African American.*

## ***Faculty and Student Areas of Responsibility:***

### ***Microwave Design and Testing:***

*Dr. Grover Larkins*

*Yazan Hijazi*

*Jorge Vargas*

*Drayton Hanna*

*Dane Fairweather*

*Albert Bogozi*

*Leon Lawrence*

### ***Superconductor and Buffer Layer Deposition and Patterning:***

*Dr. Grover Larkins*

*Dr. Yuri Vlasov*

*Dr. Mary Brezniskaya*

*Albert Bogozi*

## ***Technical Progress:***

### ***Results:***

1. Deposition of good quality 123 and BTO films on  $\text{LaAlO}_3$  by laser ablation.
2. Surface roughness caused stiction issues have moved us to sputtered films at FIU – successful.
3. Good release and patterning using sputtered SiN and Si films for MEMs fabrication at Hanscom AFB have been demonstrated with adequate yields. Poor climate (humidity in the clean room) has destroyed the superconductivity of the samples making more runs necessary. Switches however DO function – problem is with the superconductor film. – Release problems have come back to haunt this effort....
4. We demonstrated with the use of resonators incorporating switches that the insertion loss of such a switch can be less than 0.007 dB.
5. Several frequency agile resonators using switches were demonstrated along with down – state tuning of a switch.

### ***Summary:***

*The FAST center team has met its goals for this year. We have demonstrated High- $T_c$  MEM switches in filters and resonators with very low losses.*

### ***Acknowledgments:***

*We would like to thank the following people/companies for their continued support of our project. Dr. John Derov, Dr. Rick Webster and Dr. Rob Reid.*

***Publications Appearing in Print this Past Year:***

1. Corrales A., Vlasov Yu. A., Larkins G. L. BaTiO<sub>3</sub> on YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> high T<sub>C</sub> superconductors – Microwave Properties. *Integr. Ferroelectrics*, 2002, v. 42, p. 123-129.
2. Larkins G. L., Vlasov Yu. A. A comparative study of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> microwave hairpin filters vs. aluminum microwave hairpin filters. *Physica C: Superconductivity*, 2002, v. 372-376, pp. 543-545.
3. Vargas J., Larkins G., Vlasov Yu. Design, fabrication and testing of a microwave filter using YBCO on a YSZ buffered (100) Si substrate. *Physica C: Superconductivity*, 2002, v. 372-376, pp. 536-539
4. Vlasov Yu., Brown P., Sayed S., Larkins G. Superconducting microstrip resonator on YSZ buffered Si. *Physica C: Superconductivity*, 2002, v. 372-376, pp. 626-629.

***Conference presentations 2002 – 2003:***

1. Lawrence L., Hijazi Y., Noel J., Vlasov Yu.A. and Larkins G.L., Jr. "MEMS Switch High  $T_c$  Superconductor Tapped Microstrip "T" Resonator." ISEC 2003, 7-11 July 2003, Sydney, Australia, Program and Extended Abstracts, Ptu24.
2. Fairweather D., Hijazi Y., Vlasov Y.A. and Larkins G.L., Jr. "MEM Switched-Based Microwave High  $T_c$  Superconductor Resonator Tuning." ISEC 2003, 7-11 July 2003, Sydney, Australia, Program and Extended Abstracts, Ptu25.
3. Noel J., Hijazi Y., Vargas J., Vlasov Y.A. and Larkins G.L., Jr. "A Switched High  $T_c$  Superconductor Microstrip Resonator Using a MEM Switch." ISEC 2003, 7-11 July 2003, Sydney, Australia, Program and Extended Abstracts, Ptu26.



## ***Funded Spin - Off Proposals***

### ***Spin-Off Proposals Funded:***

1. Extreme dielectric loading of broad-band High Tc superconducting antennas by Grover L. Larkins, Jr. and Yuri Vlasov of the Future Aerospace Science and Technology Center for Space Cryoelectronics at Florida International University. Funded (\$160,000) by the Office of Naval Research (2002).
2. Superconducting MEM switches for microwave power applications. Funded by AFOSR (\$394,635) in November 2001. Yuri Vlasov and Grover L. Larkins